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GENEVA

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CONCEPTS OF DEPENDENCE AND ESSENTIAL DERIVATION
THE POSSIBLE USE OF DNA MARKERS

Document prepared by experts from the International Seed Federation
CONCEPTS OF DEPENDENCE AND ESSENTIAL DERIVATION
The possible use of DNA markers

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1. Definition of Essentially Derived Varieties in the UPOV Convention

“A variety shall be deemed to be essentially derived from another variety (the initial variety) when

i. It is predominantly derived from the initial variety, or from a variety that is itself predominantly derived from the initial variety, while retaining the expression of the essential characteristics that result from the genotype or combination of genotypes of the initial variety;

ii. it is clearly distinguishable from the initial variety and

iii. except for the differences which result from the act of derivation, it conforms to the initial variety in the expression of the essential characteristics that result from the genotype or combination of genotypes of the initial variety.

Essentially derived varieties may be obtained for example by selection of natural or induced mutants or of a somaclonal variant, the selection of a variant individual from plants of the initial variety, backcrossing or transformation by genetic engineering.”

Slide 4

2. ISF consideration on essential derivation

- ISF strongly supports the concept of essential derivation
- Only few internationally agreed-upon professional rules
- Essential derivation is not a new right, but is in the scope of the right of a protected initial variety
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The technical aspect

- Clear distinctness in the sense of the UPOV Convention
- Conformity to the initial variety in the expression of the essential characteristics that result from the genotype or combination of genotypes of the initial variety
- Predominant derivation from an initial variety
  => If one of these requirements is not fulfilled, there is no essential derivation
The legal aspect: dependency

- The initial variety must be a protected one
- Dependence can only exist from one protected variety alone
- It is possible to have a “cascade” of essential derivation. However, a cascade of dependence does not exist

4. Assessment of essential derivation

Takes place after establishing that the variety is distinct (DUS) and should consider the following requirements:

- Conformity to the initial variety in the expression of the essential characteristics that result from the genotype or the combination of genotypes of the initial variety
- Predominant derivation from the initial variety
Proof of predominant derivation

Various criteria or combination thereof:

- Combining ability
- Phenotypic characteristics
- Molecular characteristics
- Breeding records

5. Burden of proof

For « prima facie » proof, the following elements should be sufficient:

- Strong phenotypic similarity
- Only small differences in some simply inherited characteristics
- Strong genetic similarity

If the owner of the i.v. has fulfilled one of the above requirements, then the second breeder would have to prove that there is no predominant derivation, or that he had not used the i.v., or a variety essentially derived from that i.v.
Distance Coefficients to define a threshold (trigger point for the reversal of the burden of proof) => another interesting approach.

ISF has mainly worked on thresholds (distances measured by molecular markers)

Geneticists and statisticians: technically equally possible to measure distance coefficients using morphological markers; but that these distances are not always reflective of genetic distances or of pedigree relationships.

Use of morphological characteristics could be more difficult due to environmental factors, and much more expensive.

Threshold: divide the scale of conformity into two parts:

- below the threshold: no presumption of essential derivation,
- above the threshold: presumption of essential derivation and the burden of proof of non predominant derivation would fall on the breeder of the putative e.d.v..

Threshold will vary from species to species, depending on the existing genetic variability within the species and the established breeding procedures.
Possible use of a threshold

Zone of non-derivation  Zone of putative essential derivation

Threshold

Genetic Similarity

In any case of dispute:

- First enter into a conciliation or mediation procedure
- If that does not provide satisfactory results, enter into (binding) arbitration
- According to ISF Conciliation and Arbitration Procedure Rules.
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Choice of markers

- The markers must comply with several requirements:
  - Be “freely” available
  - Meet several technical criteria that are addressed in an ISF document “Issues to be addressed by technical experts to define molecular marker sets for establishing thresholds for ISF edv arbitration” (www.worldseed.org)
How to fix the threshold

- Use of pairs with known genealogy
- Similarity exceeding a percentile point in the distribution of similarities (upper-tail approach)

Lettuce EDV study

- Three lettuce types: 35 GH, 21 FS & 27 IC
- Longlist made to include most important varieties and maximum variation in each type.
- Varieties collected and shortlist made by ISF secretariat.
- In study both varieties and companies are coded.

Abbreviations:
GH: Greenhouse Heated
FS: Field Summer
IC: IceBerg
PCO AFLP data with 95% confidence regions

GH21 and GH22 were selected in the same F4
GH8 and GH11 come from same F3
GH30 and GH35 come from same F3
GH27 is from a cross involving GH25

Abbreviations:
q: level of conformity
genox: genotype x
genoy: genotype y
compx: company x
compy: company y

GH, Jaccard
Lettuce EDV study

- 2004: 0.96 Jaccard similarity for all 3 cultigroups
- Trigger to initiate discussions => amicable settlement => arbitration => court
- Review in 5 years

Oilseed Rape Study

- 4 Studies carried out between 2001-2006
- Bulks of 40 plants have a very high repeatability
- Bulks of 40 plants lead to a clear separation of all the varieties
- 2007: Dice dist. of 0.85 is trigger to start discussions (assessment according to protocol)
- Review in 5 yrs
Ryegrass Study

- 2002 Code of Conduct adopted
- 60 plants/variet, 5 primer comb.
- Squared Euclidean distance lower than 7=> ask for arbitration
- Apply only to varieties released after adoption
- 2004 concerns by members
- New study initiated

Ryegrass Study

- New study SSR’s (instead of AFLP’s)
- Guidelines (instead of CoC)
- Apply to all varieties
- Court possible, not only arbitration
- 1st Phase: Bulks provide same result as ind. Plants
- 2nd Phase: analyse variability in current varieties => come to threshold.
- Results expected in coming months
Cotton Study

- Literature review on mol. mrkrs in cotton
- Gen. Div. within allotetraploid cotton varieties => no EDV threshold assigned
- Different approach: parentage
- 2007: If phen. or gen. char’s suggest that 2 or more BC’s were used or coefficient of parentage value is >87.5% => put. EDV
- Threshold is trigger point for discussions
- No settlement => arbitration

Tomato Study

- Started 2006, Daniella type
- 21 hybrids & 35 parent lines
- 93 SSR markers used for data analysis
- Dice coefficient of 0.78 between F1 and parent line : trigger point for suspected use of proprietary line in production of a hybrid. [Simple matching better?]
- Continuation with cherry type
- Results by the end of 2008
Maize Study

- 150 SSR markers, highly polymorphic
- Uniformly distributed, 80% coverage
- Avg 2 mrkrs/bin, Distance > 5cM
- Min. 3 alleles/mrkr, PIC min 0.3 [0.6-0.7]

- 2008: At 82% conformity: burden of proof shifts to breeder of put. EDV
- At 90% conformity: strong indication of predominant derivation

Thank you for your attention

www.worldseed.org